MATERNAL SUPPLEMENTATION AND POSTNATAL PHYSICAL GROWTH: A REVIEW

James C. Wohlleb

The University of Texas Health Science Center
School of Public Health, Houston, Texas
United States of America

SUMMARY

Five maternal supplementation trials are compared in which mothers, but not their infants, were given food supplements and infant growth was measured as the outcome. In contrast to studies wherein children were supplemented, in addition to or exclusive of mothers, the trials under review generally failed to demonstrate any effect on physical growth.

INTRODUCTION

Martorell *et al.* (1) reviewed the effects of food supplementation on the physical growth of children. Their review did not discriminate between studies in which the supplement was directed to both children and mothers and those retricted to mothers alone. With the recent publication of results of two of the largest studies of nutritional supplementation of the mother, we now

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1 Human Nutrition Center, School of Public Health, The University of Texas Health Science Center, P. O. Box 20186, Houston, Texas 77025, USA.

have a larger body of knowledge to assess whether maternal supplementation alone affects infant growth.

Five trials (2-6) in which supplementation was limited to the mother alone, and where infant growth was studied as an outcome, are summarized in the accompanying Table. Four were directed toward mothers on marginally adequate diets in terms of recommended allowances for protein or calories (3-6). In one of these studies (5), however, mothers were later found to be consuming adequate protein and calories. In the remaining trial (2) there was only an impression reported of "the general level of diet". In each study protein was believed to be the most important component of the supplement. Four (2, 3, 5, 6) were field trials in the development of which the supplement was consumed by the mothers in their own homes. These studies included "treatment" and control groups. The other (4) was carried out in a hospital ward where mothers served as their own controls. Three were designed with sample sizes large enough to detect statistical significance for the expected size differences at birth (2, 5, 6), and the mothers were randomly allocated into treatment and control groups. In two of these (5, 6) the supplement was provided "double-blind", that is, without either the mothers or the staff knowing which mothers were given the supplement. Supplementation was provided only during gestation in the first trial (2), during lactation only in the two smaller studies (3, 4), and during both gestation and lactation in the most recent two (5, 6). Two of the investigations (3, 4) supplemented their diets with powdered skim milk and two (5, 6) with commercial formulas based on whole milk. The quantity of supplement furnished was known in all five trials, and actual intake was monitored in four of them (3-6). The customary diet was ascertained in all but one (2) of the studies; however, the substitution or replacement of the regular diet by the supplement was estimated only in one study (5). A net increase of consumption could be demonstrated in two of the investigations (5, 6).

Weight was an outcome variable in each of the trials, while length was also measured in three of them (2, 5, 6). Head and arm circumferences as well as skinfold thickness at the subscapular and triceps sites, were measured in one (5), while chest circumference was reported in another (2). In the last trial (6), abdomen and chest circumferences and triceps and subscapular skinfolds were also measured, but results have not been published.

In only one trial (4) was a significant weight gain associated

TABLE 1

MATERNAL SUPPLEMENTATION AND INFANT GROWTH
SUMMARY OF HUMAN INTERVENTION TRIALS

Ref.	Location	Customary diet	Design	N	Daily supplement	Timing	Outcomes
2	Philadelphia	Not ascertained. Impression of good diet and improvement during study	Random allocation to 3 treatment and 1 control group Tablets dispensed at hospital for home consumption. All infants fed same formula	156 148 280 300	50 g protein in tablet 50 g protein plus vitamin tablets Vitamin tablets only controls	Prenatal only; began in 1st 16 wks of pregnancy	No significant differences in weight, length, or chest circumference among groups from birth to 3 months. Two protein groups grew slightly faster. Vitamin-only group grew most slowly
3	India	1500-1800 kcal 27-50 g protein from ragi or rice cereal & occasional vegetables	Treatment group vs. placebo group Delivered to homes	15 15	Skim milk powder (30 g protein) Ca lactate, 5 g	Lactation, birth to 6 mo.	Skim milk group was smaller at birth and 6 months, but had faster weight gain from 8 to 14 weeks

4	*Western Nigeria*	Gari (grated, fermented & fried cassava) & broth of palm oil; vegetables & occasional meat or fish	Pretest/postest Hospital ward	8	Usual food with 50g protein, 2 wks/usual food with 100 g protein as skimmed milk, 2 wks	Lactation 4 wks within 2nd to 14th mo.	Greater weight gain ($P < .05$) during 3rd and 4th weeks
				3	25 g protein/100 g protein		Greater weight gain ($P < .05$) during 3rd and 4th weeks
		42 g protein 2500-3300 kcal		1	25 g protein, 4 wks/ 100 g protein, 1 wk		3.3-fold increase in weight gain during 5th week
5	Harlem, New York City	79.3 g protein 2065 kcal	Random allocation. Two levels of treatment vs. no treatment	205	Supplement: 28 g protein, 326 kcal, extra vitamins and minerals	Prenatal & lactation to 12 mo.	Suppl. > compl. > cont. (weight). Very small differences in length, head circumference arm girth & skinfolds. No statistically significant differences
			Delivered to homes	208	Complement: 4.3 g protein, 233 kcal, vitamins and minerals		
				220	Control: vitamins and minerals only		
6	Taiwan	1200 kcal 30-40 g protein. Sweet potatoes, rice et al., vegetables little fish	Random allocation. Supplement group (A)	200	40 g protein, 800 kcal milk formula-based	Lactation only for first infant, continued without interruption until weaning of a second infant	No statistically significant differences between A & B in weight, length or head circumference up to 12 mo. Second infant boys grew faster than first-infant boys in weight and head circumference
			Placebo group (B)	200	No protein, 6 kcal water with thickener. Vitamin pills dispensed to both groups		

with increased food consumption. This was observed among the smallest sample to whom the greatest supplement was delivered (protein from powdered skim milk), over the shortest time interval, in a hospital. None of the other studies found significant growth differences between infants of supplemented and control mothers.

The absence of uniformity among the five trials prevents meaningful comparisons. Sample selection varied from recruitment from a total population (6) to hospital clinics (2, 5), to unspecified selection (3, 4). The samples were drawn from population groups of North America, Asia and Africa and were composed of different ethnic and racial groups. Customary diets differed in both quantities of protein and calories as well as kinds of foods. On the other hand, supplements differed more in quantity than kind, since the common concern was the quantity of protein ingested. Delivery of the supplement varied in its timing and method. The infants whose growth was measured were fed from bottles (2), breasts (3, 4, 6), and probably in both ways (5).

Moreover, methodological difficulties weaken possible inferences. Since food records were not kept during the investigations in Philadelphia and India, the question of substitution of the regular diet by the supplement can not be answered. In Nigeria this problem was obviated by control of the diet in a hospital ward. Total calories remained constant, and only protein content was manipulated.

That mothers were sufficiently malnourished to permit an effect of supplementation is in doubt in all five projects, even though diet surveys (3-6) suggested marginal or below-recommended consumption of protein and/or energy. Dietary surveys are known to underestimate consumption, and none of the cited publications include information about the reliability or precision of the instruments employed. In the first study (2), the impression is definitely not of malnourished mothers.

Efforts to eliminate confounding factors were made by random assignment of subjects in three investigations (2, 5, 6). Whether in fact randomization was successful in this respect was tested in the Harlem and Taiwan projects, and statistical adjustments were made where appropriate. The random assignment in Philadelphia was not maintained throughout the investigation. Concerns about confounding effects also apply to the most rigidly controlled of the studies (4). On what bases the mothers were selected and assigned to study groups was not reported. This was also the only investigation conducted inside a hospital, which

itself may have facilitated effects unrelated to supplementation. Apparently no attempt to "blind" the subjects or staff was made, either.

Only a general conclusion is possible from the above comparisons: a variety of study designs carried out among diverse samples of mothers in a variety of environments, preceeding and during gestation and/or during lactation, have failed to demonstrate enhanced physical growth of their infants. This does not indicate absence of any effects of supplementation, since other factors either were not measured or not analyzed. Learning ability and personality development are two kinds of outcomes not discussed in this review which were investigated to some extent in Harlem and Taiwan. The expectation that additional energy consumed by the mothers enhanced their caretaking and nurturing has not been tested adequately. Growth of the children beyond 12 months is unknown. These negative results contrast to trials reviewed previously (1) in which children were directly supplemented (1). This contrast certainly can not justify removal of supplemental foods from mothers, although it now seems true that feeding marginally malnourished children directly is the more efficient and effective means of influencing physical development. Rather, more carefully executed trials, avoiding the errors described here or perhaps following new strategies, are needed.

RESUMEN

SUPLEMENTACION MATERNA Y CRECIMIENTO FISICO POSTNATAL: UNA REVISION

Se comparan cinco experimentos de suplementación alimentaria en los que las madres, pero no los infantes, recibieron sobrealimentación, midiéndose luego, como objetivo final, el crecimiento de los niños. En contraste con estudios en los cuales los niños han recibido directamente suplementación alimentaria, además de haberla recibido las madres también, o aun cuando ellas no la hubiesen recibido, los experimentos bajo consideración no lograron demostrar ningún efecto sobre el crecimiento físico.

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